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## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	)	Group Art Unit: 2162
PAUL E. McKENNEY ET AL.	)	
	)	
SERIAL NO.: 10/795941	)	Confirmation No.: 1342
	)	
FILED: March 8, 2004	)	
	)	Examiner: Fred A. Ehichioya
FOR: EFFICIENT SUPPORT OF CONSISTENT	)	
CYCLIC SEARCH WITH READ-COPY	)	
UPDATE	)	

Commissioner for Patents  
P. O. Box 1450  
Alexandria, VA 22313-1450

Sir:

Enclosed for the purpose of conducting a further telephonic interview and expediting the issuance of a Notice of Allowance is a set of proposed claim amendments, as follows:

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## PROPOSED CLAIM AMENDMENTS

Claim 1 (currently amended): A method for updating a shared data element group while preserving group integrity on behalf of one or more readers that are concurrently referencing group data elements without using locks or atomic instructions, comprising:

generating a new group data element;

assigning a new generation number to said new data element that is different than an existing global generation number associated with said data element group and which allows a reader of said data element group to determine whether said new data element is a correct version for said reader;

~~if a prior version of said new data element exists,~~ establishing a first version link between ~~from~~ said new data element ~~and said~~ to a prior version thereof having a different generation number;

establishing a second version link from said prior version to said new data element;

linking said new data element into said data element group so that it is reachable by readers;

updating asaid global generation number associated with said data element group to correspond to said new generation number; and

~~if a prior version of said new data element exists,~~ freeing said prior version and said first and second version links following a grace period.

Claim 2 (original): A method in accordance with claim 1 wherein said method is used to replace a group data element and said new data element is generated by copying said data element to be replaced.

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Claim 3 (original): A method in accordance with claim 1 wherein said method is used to delete a group data element and said new data element is generated by copying said data element to be deleted and setting a deletion flag in said new data element.

Claim 4 (original): A method in accordance with claim 1 wherein said method is used to insert a new group data element and said new data element has no prior versions.

Claim 5 (original): A method in accordance with claim 1 wherein said method further includes generating a pointer-forwarding entity that points to said new data element, said pointer forwarding entity maintaining said version link on behalf of said new data element and further being used to link said new data element into said data element group.

Claim 6 (currently amended): A method for updating a shared data element group while preserving group integrity on behalf of one or more readers that are concurrently referencing group data elements without using locks or atomic instructions, comprising:

generating a pointer-forwarding entity that points to a data element in said data element group;

assigning a new generation number to said pointer-forwarding entity that is different than an existing global generation number associated with said data element group and which allows a reader of said data element group to determine whether said pointer-forwarding entity is a correct version for said reader;

~~if there is a prior version of said pointer forwarding entity, establishing a first version link between~~from said pointer-forwarding entity ~~and said~~to a prior version ~~thereof~~;

establishing a second version link from said prior version to said new data element;

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linking said pointer-forwarding entity into said data element group so that said data element pointed to by said pointer-forwarding entity is reachable by readers through said pointer-forwarding entity;

updating asaid global generation number associated with said data element group to correspond to said new generation number; and

~~if a prior version of said pointer forwarding entity exists, freeing said prior version~~  
and said first and second version links following a grace period.

Claim 7 (original): A method for performing a search of a shared data element group that may be undergoing modification in accordance with the method of claim 1, comprising:

assigning a current global generation number to said search;

when referencing a data element in said data element group, determining whether said referenced data element is a correct version by comparing a generation number assigned to said referenced data element with said search generation number; and

searching for a correct version of said referenced data element as necessary.

Claim 8 (original): A method in accordance with Claim 7 wherein, if said data element generation number is equal to said search generation number, said referenced data element is accepted for reading as a correct version.

Claim 9 (original): A method in accordance with Claim 7 wherein, if said data element generation number is less than said search generation number, a search is made for a later version of said referenced data element, and wherein said referenced data element is used if a later version is not found.

Claim 10 (original): A method in accordance with Claim 7 wherein, if said data element generation number is greater than said search generation number, a search is made for a prior

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version of said referenced data element, and wherein said referenced data element is deemed to be a new insertion if there is no prior version.

Claim 11 (currently amended): A data processing system having one or more central processing units, a memory and a communication pathway between the one or more central processing units and the memory, said system being adapted to update a shared data element group in said memory while preserving group integrity on behalf of one or more readers that are concurrently referencing group data elements without using locks or atomic instructions, and comprising:

means for generating a new group data element;

means for assigning a new generation number to said new data element that is different than an existing global generation number associated with said data element group and which allows a reader of said data element group to determine whether said new data element is a correct version for said reader;

means for establishing, ~~if a prior version of said new data element exists,~~ a first version link ~~between~~from said new data element ~~and said~~ to a prior version thereof;

means for establishing a second version link from said prior version to said new data element;

means for linking said new data element into said data element group so that it is reachable by readers;

means for updating a~~said~~ global generation number associated with said data element group to correspond to said new generation number; and

means for freeing, ~~if a prior version of said new data element exists,~~ said prior version and said first and second version links following a grace period.

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Claim 12 (original): A system in accordance with claim 11 wherein said system is adapted to replace a group data element and to generate said new data element by copying said data element to be replaced.

Claim 13 (original): A system in accordance with claim 11 wherein said system is adapted to delete a group data element and to generate said new data element by copying said data element to be deleted and setting a deletion flag in said new data element.

Claim 14 (original): A system in accordance with claim 11 wherein said system is adapted to insert a new group data element such that said new data element has no prior versions.

Claim 15 (original): A system in accordance with claim 11 wherein said system further includes means for generating a pointer-forwarding entity that points to said new data element, said pointer forwarding entity maintaining said version link on behalf of said new data element and further being used to link said new data element into said data element group.

Claim 16 (currently amended): A data processing system having one or more central processing units, a memory and a communication pathway between the one or more central processing units and the memory, said system being adapted to update a shared data element group in said memory while preserving group integrity on behalf of one or more readers that are concurrently referencing group data elements without using locks or atomic instructions, and comprising:

means for generating a pointer-forwarding entity that points to a data element in said data element group;

means for assigning a new generation number to said pointer-forwarding entity that is different than an existing global generation number associated with said data element group

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~~and which~~ allows a reader of said data element group to determine whether said pointer-forwarding entity is a correct version for said reader;

~~means for establishing, if there is a prior version of said pointer-forwarding entity, a first version link between from~~ said pointer-forwarding entity and ~~said a~~ prior version ~~thereof~~;

~~means for establishing a second version link from said prior version to said pointer-forwarding entity;~~

means for linking said pointer-forwarding entity into said data element group so that said data element pointed to by said pointer-forwarding entity is reachable by readers through said pointer-forwarding entity;

means for updating ~~a~~ said global generation number associated with said data element group ~~to correspond to said new generation number~~; and

means for freeing, ~~if a prior version of said pointer-forwarding entity exists~~, said prior version ~~and said first and second version links~~ following a grace period.

Claim 17 (original): A data processing system having one or more central processing units, a memory and a communication pathway between the one or more central processing units and the memory, said system being adapted to perform a search of a shared data element group that may be undergoing modification by the system the system of claim 11, and comprising:

means for assigning a current global generation number to said search;

means for determining, when referencing a data element in said data element group, whether said referenced data element is a correct version by comparing a generation number assigned to said referenced data element with said search generation number; and

means for searching for a correct version of said referenced data element as necessary.

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Claim 18 (original): A system in accordance with Claim 17 wherein said system is adapted to accept said referenced data element for reading as a correct version if said data element generation number is equal to said search generation number.

Claim 19 (original): A system in accordance with Claim 17 wherein said system is adapted to search for a later version of said referenced data element if said data element generation number is less than said search generation number, and to use said referenced data element if a later version is not found.

Claim 20 (original): A system in accordance with Claim 17 wherein said system is adapted to search for a prior version of said referenced data element if said data element generation number is greater than said search generation number, and to deem said referenced data element to be a new insertion if there is no prior version.

Claim 21 (currently amended): A computer program product for updating a shared data element group while preserving group integrity on behalf of one or more readers that are concurrently referencing group data elements without using locks or atomic instructions, comprising:

- one or more data storage media;

- means recorded on said data storage media for programming a data processing platform to operate as by:

- generating a new group data element;

- assigning a new generation number to said new data element that is different than an existing global generation number associated with said data element group and which allows a reader of said data element group to determine whether said new data element is a correct version for said reader;



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~~if a prior version of said new data element exists, establishing a first version link between from said new data element and said to a prior version thereof;~~  
\_\_\_\_\_ establishing a second version link from said prior version to said new data element;  
linking said new data element into said data element group so that it is reachable by readers;  
updating said global generation number associated with said data element group to correspond to said new generation number; and  
~~if a prior version of said new data element exists, freeing said prior version and said first and second version links following a grace period.~~

Claim 22 (original): A computer program product in accordance with claim 21 wherein said product is adapted to replace a group data element and to generate said new data element by copying said data element to be replaced.

Claim 23 (original): A computer program product in accordance with claim 21 wherein said product is adapted to delete a group data element and to generate said new data element by copying said data element to be deleted and setting a deletion flag in said new data element.

Claim 24 (original): A computer program product in accordance with claim 21 wherein said product is adapted to insert a new group data element such that said new data element has no prior versions.

Claim 25 (original): A computer program product in accordance with claim 21 wherein said means recorded on said data storage media are further adapted to generate a pointer-forwarding entity that points to said new data element, said pointer forwarding entity maintaining said version link on behalf of said new data element and further being used to link said new data element into said data element group.

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Claim 26 (currently amended): A computer program product for updating a shared data element group while preserving group integrity on behalf of one or more readers that are concurrently referencing group data elements without using locks or atomic instructions, comprising:

one or more data storage media;

means recorded on said data storage media for programming a data processing platform to operate as by:

generating a pointer-forwarding entity that points to a data element in said data element group;

assigning a new generation number to said pointer-forwarding entity that is different than an existing global generation number associated with said data element group and which allows a reader of said data element group to determine whether said pointer-forwarding entity is valid for said reader;

~~if there is a prior version of said pointer-forwarding entity, establishing a first version link ~~between~~from said pointer-forwarding entity and ~~said~~ a prior version thereof;~~

establishing a second version link from said prior version to said pointer-forwarding entity;

linking said pointer-forwarding entity into said data element group so that said data element pointed to by said pointer-forwarding entity is reachable by readers through said pointer-forwarding entity;

updating asaid global generation number associated with said data element group to correspond to said new generation number; and

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~~if a prior version of said pointer forwarding entity exists, freeing said prior version~~  
and said first and second version links following a grace period.

Claim 27 (original): A computer program product for performing a search of a shared data element group that may be undergoing modification in accordance with the method of claim 1, comprising:

one or more data storage media;

means recorded on said data storage media for programming a data processing platform to operate as by:

assigning a current global generation number to said search;

when referencing a data element in said data element group, determining whether said referenced data element is a correct version by comparing a generation number assigned to said referenced data element with said search generation number; and

searching for a correct version of said referenced data element as necessary.

Claim 28 (original): A computer program product in accordance with Claim 27 wherein, if said data element generation number is equal to said search generation number, said referenced data element is accepted for reading as a correct version.

Claim 29 (original): A computer program product in accordance with Claim 27 wherein, if said data element generation number is less than said search generation number, a search is made for a later version of said referenced data element, and wherein said referenced data element is used if a later version is not found.

Claim 30 (original): A computer program product in accordance with Claim 27 wherein, if said data element generation number is greater than said search generation number, a search is

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made for a prior version of said referenced data element, and wherein said referenced data element is deemed to be a new insertion if there is no prior version.

Claim 31 (original): A computer program product for managing a shared data element group so as to allow updates thereof while preserving group integrity on behalf of one or more readers that are concurrently referencing group data elements without using locks or atomic instructions, comprising:

- one or more data storage media;

- means recorded on said data storage media for programming a data processing platform to operate as by:

- performing a first-phase update operation that preserves a consistent pre-update view of said data element group on behalf of pre-update readers and a consistent post-update view of the data element group on behalf of post-update readers;

- providing means by which readers can locate all data elements of said data element group that belong to each of said pre-update and post-update views as readers search said data element group;

- performing one or more read operations following said first-phase update operation in which one or more readers search said data element group with each reader referencing only data elements belonging to one of said pre-update and post-update views; and

- performing a second-phase update operation following a grace period that frees said pre-update view of said data element group.

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## REMARKS

The claim amendments proposed herein address issues discussed in an initial telephonic interview conducted on even date herewith. In particular, independent claims 1, 6, 11, 16, 21 and 26 have been amended to remove the conditional “if” language from paragraphs of said claims. Additional clarifying amendments have also been made to better illustrate the nature and operation of the claimed subject matter. The proposed amendments do not constitute a request to withdraw the present appeal, and are made for the sole purpose of conducting a further telephonic interview and hopefully reaching an agreement on allowability. If such agreement cannot be reached, applicants request that the appeal proceed based on the claims set forth in applicants’ appeal brief.

Respectfully Submitted,

/Walter W. Duft/

Walter W. Duft  
Registration No. 31,948  
Customer No. 51167

8616 Main Street, Suite 2  
Williamsville, New York 14221  
(716) 633-1930 (voice)  
(716) 633-1932 (fax)  
wduft@duftlawoffice.com